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# Implementing the Cultural Dimension into a Command and Control System

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**14. ABSTRACT**

Current command and control (C2) operations are centered on addressing the root causes of state failure and instability. For success, these C2 operations require the cooperation of local populations and governments. To win this cooperation, we need to be able to predict changes in the opinions of local populations. Cultural identity is a critical factor in this process. These cultural identities are multi-layered and dynamic. In order to predict the impact of events on a population's attitude, one must remember that each person has several different identities and that some of these identities may change. Further people's attitudes change based on their contact with other individuals. When people's attitudes change, then their participation in groups changes as well. SCIPR (Simulation of Cultural Identities for Prediction of Reactions) is an agent based computer simulation that forecasts the effects of actions on peoples' opinions and cultural identities to better model the underlying forces driving attitude based conflicts. In this paper, we will describe the development of the SCIPR model and its application for current C2 operations.

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## Abstract

*Current command and control (C2) operations are centered on addressing the root causes of state failure and instability. For success, these C2 operations require the cooperation of local populations and governments. To win this cooperation, we need to be able to predict changes in the opinions of local populations. Cultural identity is a critical factor in this process. These cultural identities are multi-layered and dynamic. In order to predict the impact of events on a population's attitude, one must remember that each person has several different identities and that some of these identities may change. Further people's attitudes change based on their contact with other individuals. When people's attitudes change, then their participation in groups changes as well. SCIPR (Simulation of Cultural Identities for Prediction of Reactions) is an agent based computer simulation that forecasts the effects of actions on peoples' opinions and cultural identities to better model the underlying forces driving attitude based conflicts. In this paper, we will describe the development of the SCIPR model and its application for current C2 operations.*

## 1. Introduction

In the wake of September 11th, the wars in Afghanistan and Iraq have increasingly pushed the armed services to contend with non-traditional enemies in complex, asymmetric environments. Even during the 1990s, American involvement in Somalia, Kosovo, and Haiti showed that a central challenge for the U.S. lies not in fighting nation-state armed forces like our own, but in dealing with more irregular forces. These forces include terrorist networks that move across international boundaries, insurgent militia forces that operate against U.S. and allied forces conducting stabilization operations, and warring factions that attack U.S. and allied forces conducting peacekeeping or humanitarian operations.

The literature is consistent in stating, that a large part of waging a successful counter-insurgency campaign involves reducing or eliminating local support for the insurgents by convincing people that it is in not in their interest to support or join an insurgency. For example, numerous researchers have stated that terrorism begins when one portion of a society feels aggrieved. In other words, terrorism or insurgency can occur when the attitude of a portion of a society is favorable towards terrorists and unfavorable towards the state (e.g., [1, 2, & 3]). As such, the United States Marine Corps has stated "the center of gravity for counterinsurgency operations is the good will of the people" [4].

In light of this knowledge, the military has turned to Effects- Based Operations (EBO). EBO means increasing focus on the effects of actions on attitudes and behaviors, rather than on targets and damage infliction alone [5]. This is a challenge for traditional command and control (C2) systems. Determining the behavioral and psychological effects of a particular action would be difficult enough even if it were done in a country with a familiar culture. It becomes more difficult still when the action is undertaken in an unfamiliar multi-cultural environment like Iraq. This presents a daunting problem for the commander who must contend with culturally complex situations as they seek to understand what effects various actions might produce; a problem that is currently not met by C2 systems.

A further difficulty for such systems has been identified in the comparative politics literature. A consensus has emerged that "individuals possess multiple identities and often shift from one identity to another" and "identities can change across time and space" [6]. In other words, **cultural identities are neither monolithic nor static**. An individual person can have multiple cultural identities because he or she belongs to a number of different groups. Cultural identities are also dynamic**.** As opinions change, group membership and hence identity change. Further, views

and identities may be dynamic, complex, and even contradictory within the same person.

To predict effects in a multi-cultural operational environment, it is essential to model individuals subscribing to multiple cultural identities, and to **model the identities as dynamic and changeable**. By ignoring multiple dynamic cultural identities, commanders would be ignoring a rich set of tools with which to achieve their goals. As such, much of the struggle in asymmetric warfare is to convince people who support our adversaries that they should support us (or support our adversaries less).

SCIPR, a unique C2 system, was developed to account for the ways in which people interpret and react to events. It enables users to ask what-if questions in order to gauge the effects of alternative courses of action on the identities and opinions of friends, foes, those in between, and those who are ambivalent. In the remainder of this paper, we will describe the theory behind the development of this C2 and how it is being used currently.

## 2. Theory

The use of SCIPR begins with the input of data about the region of study and population into a structured database. In addition, baseline data is input regarding the opinions that are held by the cultural identities as well as degree of reactions that will occur to certain event categories. This database is then linked to model elements to create a proportionally representative agent population in the SCIPR model. Inside the SCIPR model influence triggers lead to thousands of interactions between the agents and events that evaluate changes in opinion and social identity using the theory described in the SCIPR background. These changes are recorded back to the database for further analysis and reporting. Each of these processes follows a carefully designed methodology that seeks to maintain a balance between a sufficient level of detail and a manageable level of complexity.

The theoretical basis for SCIPR's algorithms comes from the integration of social identity theory and social influence theories. Social identity theory was originally developed by Henri Tajfel and John Turner [7,8]. Many other scholars have continued to develop and test the hypotheses of social identity theory, notably Abrams and Hogg [9]. Currently, social identity theory is the most well-developed and well-tested theory of cultural change. Social identity theory is highly compatible with theories of social influence (e.g., [10, 11]). As well as other classic research into aspects of social influence such as conformity [12] and group conflict [13, 14], which are also important to understanding how individuals' identities can change in reaction to events. The following sections describe each of these processes in greater detail.

The most important variables related to social identity theory [8] are identity and opinion. In social identity theory, people may have multiple identities to which they subscribe at any one time. Minimally, a person has a unique individual identity that determines opinions, perceptions, and actions. In addition, almost all people identify themselves as members of groups. Categories of groups may be at any level of analysis. For example, some groups may be: gender, age, race, religion, political affiliation, etc… Social identity theory is concerned most with this perception of identity and the actions that arise from this perception, rather than institutional membership in a group (being a registered member of the Republican Party or Democratic Party). Depending on the group and the person, a person may hold multiple identities with regard to the same category. For example someone may consider himself as both a Republican and a Democrat.

Cameron [15] suggests three dimensions of identity: ***cognitive centrality, ingroup affect,*** and ***ingroup ties***. Cognitive centrality is the amount of time a person thinks about being a member of a group. This variable represents the enduring psychological salience of group identification. Ingroup affect represents the degree to which a person feels good when he thinks about a group he is in. This variable represents the value a person places on a group identity. Ingroup ties are a measure of how much a person feels he shares a group's fate. For example, a person is either a man or a woman, and this identification is very difficult to change. Conversely, one may easily leave a political party. As such, a woman in a society without many opportunities for women will have strong ingroup ties to the group "women". Conversely, the average American citizen who votes Democrat in one election may have weak ingroup ties to the Democratic Party and show this in the next election by voting Republican.

The second concept of importance in social identity theory is opinion. The most useful variables to describe opinion come from models of opinion dynamics (e.g., [11, 16, 17, 18]). These variables are ***opinion*** and ***certainty***. Opinion is the name of the feeling/judgment about something in the world. Certainty is the strength with which the opinion is held.

Social identity theory [8, 19, 20] and theories of social influence [10, 12, 21, 22] suggest three main reasons that people change their identities and opinions: improvement of ***self esteem,*** increase of

***certainty*** (decrease of uncertainty) about the world, and ***conformity*** to social pressure. The self esteem motivation theory [8] says that a person can improve his/her self esteem by identifying with a group and thinking about how his/her group is good in some way (better than other groups, improving over time, better than some benchmark, etc…). A person can improve his/her certainty about the world by identifying with groups and taking on their opinions [19, 20] and by communicating with other people to find out their opinions [21]. A person can also be motivated by the desire to belong, the fear of physical punishment, and the fear of social stigma to change identities and attitudes to conform to the opinions of other people [12, 22]. The above is an overview of relevant theories. We now turn to how these theories are applied as mechanisms for identity and opinion change within SCIPR.

## 3. Mechanisms for Identity Change

As noted, in social identity theory [8], a person identifies with (joins) a group in order to improve self esteem [8] and increase certainty [20] about his/her identity (which consists of certainty about the person's various opinions). People join those groups which (1) have an opinion similar to the person's opinion along the salient category, (2) have a relatively high status compared to other groups along the salient category, and are (3) permeable enough to allow the person to identify with the group.

Cognitive centrality and ingroup affect are two important concepts in the establishment and maintenance of identity. A person's cognitive centrality is the long term level of identification with a group and the ingroup affect is the value placed on having that identity. There is a positive feedback loop with identity. A person identifies more with a group if s/he likes the group and identifies less with a group if s/he dislikes the group. A person's liking/affect towards a group is determined by the amount of self esteem and certainty a person gains by being a member of the group.

A person gains self esteem in a group by comparing the group status to the status of other groups along some category of comparison, comparing his group to its past status, or comparing the group to some outside standard. If a person perceives the group status to be lower than what is expected, s/he will feel a sense of relative deprivation [14].

Another component of identity, ingroup ties, seems to be related to permeability. Permeability determines how easy it is for a person to increase and decrease the identification with a group and the upper and lower levels on that identification. For example, a man cannot easily identify himself as a woman or totally get rid of his identification as a man.

Since a group is simply a set of individuals with various opinions, a person uses the cognitive construct of a group prototype to think of a group as one entity with a set of "prototypical opinions" for the purpose of evaluating how close the group's opinion is to that of the person along the salient category of comparison. One evaluates the prototypical opinion of a group against one's own opinions. The groups whose opinions are closest to one's own will be the group with which the person will identify his/herself.

## 4. Mechanisms for Opinion Change

The mechanisms of opinion change in the SCIPR model are based on social influence and bounded confidence models. Social influence occurs when there is contact between a message sender and a message receiver. Either the sender or the receiver may initiate the communication. The message sender attempts to communicate a position about an opinion to the sender. As a result of this conversation, the receiver of the message may shift his/her opinion some distance towards or away from that of the sender's opinion. Additionally, the receiver may decrease his/her uncertainty about an opinion that changes as a result of the conversation.

The most basic variables related to social influence are the receiver opinion, receiver uncertainty, sender opinion, and sender uncertainty. These variables form the basis of an important set of agent-based models called continuous opinion dynamic models (including a subset called bounded confidence models). Models of continuous opinion dynamics [11, 16, 17, 18] are the most popular way to study the dynamics of social influence using agents, although several other approaches are also promising [23, 6].

In continuous opinion dynamics models, the larger the gap between sender and receiver opinion, the less the receiver changes his opinion to match that of the sender. The uncertainty of the receiver influences the effect of the gap between sender and receiver opinion on the change in receiver opinion. Bounded confidence models portray receiver opinion as a point along a single dimension in some category of opinion.

For example, there may be a category called attitude toward political figure, which exists as a set of values along one dimension. At one end of the dimension is strong attitude against the political figure. At the other end of the category is strong attitude for

the political figure. Each agent in the bounded confidence model will have an opinion of the political figure.

Furthermore, this opinion is held with a certain degree of confidence (or strength). This confidence is usually represented as either a symmetrical or asymmetrical set of thresholds. This confidence impacts the ability of the receiver's opinion to change. If the sender's opinion of the political figure falls beyond the thresholds of the receiver's opinion, then the receiver will not change his/her opinion about the political figure toward that of the sender. When this happens, the receiver either does not change his opinion at all and ignores the sender, or moves his opinion away from that of the sender.

As an example, suppose the dimension of for/against the political figure is from -1 to 1, with 0 as indifference towards the political figure. The receiver has some opinion about the political figure, say +.5 that says that s/he is moderately in favor of the political figure. The receiver also has a set of thresholds around this opinion representing his/her certainty about this opinion. One threshold is at -.1 and the other is at +.7. The closer the opinion of the sender is to +.5, the more the receiver will be influenced by it. As the sender's opinion moves towards the receiver's thresholds (from +.5 to -.1, for example), the receiver is less likely to be swayed to the opinion of the sender. If the sender's opinion is outside the receiver's thresholds (less than -.1, for example), the receiver will either ignore a social influence attempt by the sender, or will shift his/her opinion away from that of the sender. If the sender's opinion is -.2, the receiver will either keep his/her original opinion or change his/her attitude to the political figure (by moving it from +.5 to +.7, for example).

When a receiver moves his/her opinion as the result of social influence, the thresholds move to re-center around his/her new opinion. Some bounded confidence models also suggest that after a change in opinion, the receiver's opinion strengthens and the thresholds around that opinion tighten. So, if the receiver starts with an opinion of +.5, and thresholds of -.1 and +.7, s/he may move his/her opinion to +.7, shift the thresholds to center on the new mean, and tighten them, for example to +.3 and +.8.

Other aspects that impact the proclivity of opinion change are the frequency of communication between sender and receiver and the propensity of the receiver to listen to the sender's message [24]. These variables are, in turn influenced by the structural properties of the network ties between sender and receiver (and the structure of the network in general) and the similarity between sender and receiver. In his model of social influence, Fridken [10] suggests that a receiver is more likely to change his opinion to that of the sender if (1) the sender and the receiver occupy similar positions in the network, (2) the sender and the receiver are members of the same subcomponent of a network (a collection of people who have many mutual ties with each other, but not others in the network), and (3) the sender has a high degree of structural centrality in the network.

Related to these concepts, social identity theory [8] holds that the more similar the social identities of the sender and the receiver are (along a salient category), the more likely the sender is to listen to the opinions of the receiver. This suggests another feedback mechanism. Since a person tends to identify most with those groups that have members with similar opinions to the person, it is logical that a person will listen more to fellow members than non-members, regardless of opinion. What this means is that if a sender's opinion is very different than that of the receiver, the receiver is more likely to listen to the sender's opinion if the two share a salient identity.

As noted, the above was a brief overview of the mechanisms in SCIPR as to how agents change identities and opinions. What is not mentioned is the integration of both of these. They are indeed highly integrated in that opinions change based on our peer groups and our peer groups change based on our opinions. In the next section, we describe the mechanisms by which the SCIPR model quantifies the interaction of opinion and identity change.

## 5. Model Behavior

The model behavior is the result of the integrated social dynamics of identity and opinion change. The agent population is only a fraction of the actual population being studied, yet the initial identity and opinion makeup remains proportional to what is observed through census data and surveys. Each agent therefore maintains information about its identities, opinion, and the social network it interacts with.

Figure 1 provides an overview of the interactions that take place as well a summary of the causal relationships that emerge from thousands of individual exchanges. The causal links shown also describe how the different social theories discussed in the previous sections are integrated within the model. Of particular interest are the causal relationships that close to form feedback loops. Feedback loops create effects that either reinforce or balance out a particular behavior in each agent. Depending on the current strength of any particular loop, a wide range of

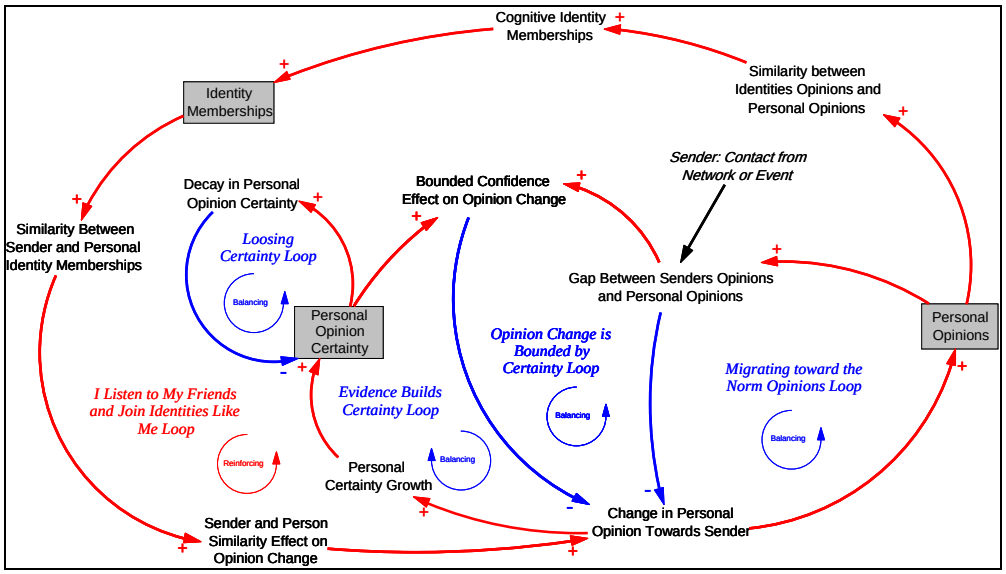


Figure 1. Overview of interactions within SCIPR.

behaviors can be exhibited by agents and groups of agents. Examining each of these loops in isolation helps to explain a particular driver in the overall outcome.

Starting with *Identity Memberships*, each agent maintains a cognitive identity to all possible identities. These cognitive identities are derived from comparisons between the agent's current opinions and the norms of a particular identity. An agent's opinions change over time and the amount of change is partly determined by the identity similarity between an agent and the agent sending its opinion. This forms an abstract loop between agents that leads them to, on average, listen to and join identities that are similar to its own.

Changes in opinion are not just influenced by the identity of the sender however. If an agent is going to change at all, it is in the direction of the gap between the sender's opinion and its own. As these changes occur over time, the agents tend to move toward particular identity norms. The amount of change is also governed by the amount of certainty an agent has in its current opinion. This certainty builds over time as an agent receives more and more outside information. As the amount of information of a given opinion declines an agent's certainty may also decay.

The behavior of the SCIPR model is observed by recording the individual changes in opinion and identity affiliation. These results can then be aggregated and sorted to identify interesting trends in a population's opinions and identity makeup. Simulations of the SCIPR model have shown a wide range of possible behaviors from populations of differing composition, initial opinion states, and ongoing events. Different case studies have demonstrated reasonable approximations the broader trends in a population such as the political party support in Northern Ireland elections as shown in Figure 2.

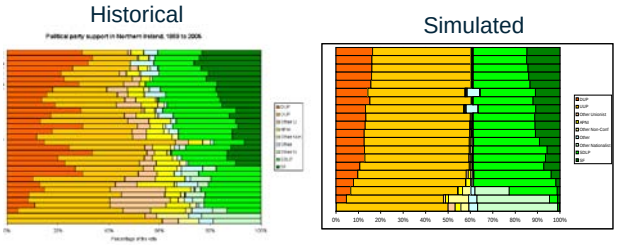


Figure 2. Comparison of historical data and SCIPR output for results of elections in Northern Ireland over time.

## 6. Conclusions

In conclusion, SCIPR is a unique C2 tool that allows military planners to gauge the impacts of Courses of Action on the attitudes and group membership of a population. It is an agent based computer simulation that draws on extensive research of multi-agent modeling of artificial societies and in particular the use of these models to simulate identity and social influence dynamics [25, 26, 17]. Further, it draws from the theories of social identity [8] and social influence theory [10] for the mechanisms of identity and opinion change. A fully functioning prototype of SCIPR is currently being used by an operational command for this purpose in theater.

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